IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No: 09/967,307 Examiner: El Hadji Malick Sall

Filing Date: September 28, 2001 Group Art Unit: 2157

Inventor: Brian A. Batke Confirmation No.: 6750

Title: *Industrial Control System with Autonomous Web Server*

Attorney Docket No. 1506.021

APPELLANTS' AMENDED APPEAL BRIEF

Mail Stop – Appeal Brief - Patent
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Sir:

On or about March 19, 2007, Appellant appealed from the Final Rejection of claims 1-22 and submitted Remarks Accompanying Pre-Appeal Brief Request for Review. On May 4, 2007, a Notice of the Panel Decision from Pre-Appeal Brief Review concluded that there was at least one actual issue for appeal.

The following Appellant's Amended Appeal Brief is submitted pursuant to a Notification of Non-Compliant Appeal Brief pursuant to 37 CFR 41.37. Please charge any additional fees to Deposit Account No. 50-1170.

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REAL PARTY IN INTEREST

The real party in interest of the above-identified application is Rockwell Automation, Inc., a Delaware Corporation, located and doing business at 1201 South Second Street, Milwaukee, Wisconsin.

RELATED APPEALS AND INTERFERENCES

None.

STATUS OF CLAIMS

The Examiner has rejected claims 1, 4, 12, 14, and 15 under 35 U.S.C. §103(a) as being unpatentable over Lindner (US 6,640,140) in view of Papadopoulos (US 6,484,061). Claims 7-8, and 18-19 have been rejected over Lindner in view of Papadopoulos (US 6,061,603). Claims 2 and 13 have been rejected over Lindner in view of Katsuhiko (JP 10-011325). Claims 5 and 16 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Lindner in view of Brown (US 6,542,925). Claims 6, 9-11, 17 and 20-22 have been rejected under 35 U.S.C. §103(a) as being unpatentable over Lindner in view of Brown in further view of Papadopoulos (US 6,061,603). Claim 3 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Lindner in view of Hauet (6,799,077).

All of the claims have been finally rejected, and the rejection of claims 1-22 is appealed herein. The claims, as they presently stand, are found in the Claims Appendix to this Appellant's Appeal Brief.

STATUS OF AMENDMENTS

No claim amendments are now pending.

SUMMARY OF CLAIMED SUBJECT MATTER

The citations in the following section refer to paragraph numbers of the published application.

The present invention relates to an "industrial control system" typically comprised of a "programmable logic controller" (PLC), and one or more input/output (I/O) modules. The PLC is a special purpose computer that runs a stored control program to communicate with the I/O modules, the latter which are attached to sensors and actuators used to control an industrial process. The components of the industrial control system may be separated and may communicate with the PLC via a controller network using a "connected messaging" protocol. Connected messaging establishes a connection between two components on a network that ensures reliable transmission. *Specification: paragraph [0003]-[0006].*

The prior art teaches the connection of a Web server to the backplane of the PLC to communicate directly with the PLC. Input and output data between the Web and the I/O modules is mediated by the PLC. *Specification: paragraph [0008].*

The present invention provides a Web server module that may communicate directly with the I/O modules using the controller network without the intervention of the PLC. In this way, remote control of the I/O modules can be effected using a simple Web browser program even before the PLC is programmed or otherwise operational. In addition, this invention allows control of the industrial process from the Web in the event of a failure of the PLC, for example, to shut the process down safely. *Specification: paragraph [0010].*

A challenge to the invention allowing direct communication from the Web with the I/O modules, is the problem of conflicts between instructions from the PLC and instructions from the

Web server module. These conflicts may be inadvertent, or may result from malicious Internet traffic. *Specification: paragraph [0011].*

The present invention solves this problem through the use of a "write disable command" that may be sent to the Web server module from the PLC to selectively block output data from coming from the Web. *Specification: paragraph [0011].*

The above description gives an overall summary of the preferred embodiment of the invention. The following summarizes the claims at issue.

Claim 1 is an independent apparatus claim that recites an industrial control system (10) having a programmable logic controller (18) communicating over a controller network (24) with a plurality of I/O modules (28) the latter communicating with an industrial process (32) sending and receiving electrical signals to and from the industrial process. Such an industrial control system can be seen in Fig. 1 of the present application. *Specification: paragraph [0031]-[0035].*

The invention provides a Web interface module (26) communicating with the Internet (36) via an Internet interface (50) and with the industrial control network (24) via a network interface (52). Importantly, the Web interface module (26) may pass data from the Web directly to the I/O modules (28) to produce output signals sent to the industrial process without the intervention of the programmable logic controller (18). *Specification: paragraph [0036]-[00 38]; [0042].*

Claim 2 is an apparatus claim dependent on claim 1 which recites that the Web interface module (26) may receive a "write disable command" from the programmable logic controller 18 preventing direct writing of data to the I/O modules (28) from the Web. *Specification: paragraph [0043]-[0045].*

Claim 3 is an apparatus claim dependent on claim 1 which recites that the Web interface module (26) communicates with the I/O modules using a "connected messaging protocol". *Specification: paragraph [0034], [0036].*

Claim 7 is an apparatus claim dependent on claim 1, which recites that the communication between the Web and the I/O modules is via an I/O image table (64). *Specification: paragraph [0004];[0039].*

Claim 12 is an independent apparatus claim that recites an industrial control system comprising a plurality of I/O modules (28) sending and receiving electrical signals to and from an industrial process (32), a controller network (24) communicating with the I/O modules (28), a programmable logic controller (18) attachable to the controller network (24) to execute a stored control program to exchange data with the I/O modules (28) over the controller network (24) to control the industrial process (32). *Specification*: *paragraph* [0031]-[0035]

The invention additionally provides a Web interface module (26) including an Internet interface (50) for connecting to a Web accessing communications medium (34), a network interface (52) for connecting to the controller network (24), and a processing unit executing a stored interface program to communicate directly with at least one I/O module (28) and to pass data between the Web accessing communications medium (34) and the I/O module (28), whereby communications may be had with the I/O module (28) without intervention of the programmable logic controller. *Specification*: *paragraph [0036]-[0038]; [0042].* Claim 13 corresponds generally to claim 2 with respect to support in the specification.

Claim 14 is an independent apparatus claim which recites an industrial control system comprising a plurality of I/O modules (28) sending and receiving electrical signals to and from an industrial process (32), a connected messaging network (24) communicating with the I/O

modules (28), a programmable logic controller (18) attachable to the controller network to execute a stored control program to open connections and exchange data with the I/O modules over the connected messaging network to control the industrial process. *Specification*: *paragraph [0031]-[0036]*.

The invention further provides a Web interface module (26) that includes an Internet interface (50) for connecting to a Web accessing communications medium (34), a network interface (52) for connecting to the connected messaging network, and a processing unit executing a stored interface program to open connections on the connected messaging network between at least one I/O module and the Web interface module (26) and to pass data between the Web accessing communications medium(34) and the I/O module (28) whereby communications may be had with the I/O module (28) without intervention of the programmable logic controller (18). *Specification*: *paragraph [0036]-[0038]; [0042]*. Claim 18 corresponds generally to claim 7 with respect to support in the specification.

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

The issues presented for review are as follows:

I. Whether claims 1 and 12 are patentable under 35 U.S.C. §103(a) over U.S. Patent No. 6,640,140 to Lindner (the Lindner patent) in view of U.S. Patent No. 6,484,061 to Papadopoulos (the Papadopoulos '061 patent). These claims require a direct connection between a Web interface and an I/O module without mediation by the programmable logic controller.

II. Whether claims 2 and 13 are unpatentable under 35 U.S.C. §103(a) as being unpatentable over Lindner in view of Katsuhiko. These claims require a memory locking mechanism to prevent the I/O modules from being changed by spurious Web messages.

III. Whether claims 3 and 14 are unpatentable under 35 U.S.C. §103(a) as being unpatentable over Lindner in view of Hauet or conversely in view of Papadopoulos '061. These claims require "connected messaging" between the Web interface and the I/O modules.

IV. Whether claims 7 and 18 are unpatentable under 35 U.S.C. §103(a) as being unpatentable over Lindner in view of Papadopoulos '603. These claims require an I/O image table in the Web interface used as a vehicle for coordinating asynchronous data transfers between the Web and the I/O modules.

For the purposes of this appeal, claims 1 and 12 stand or fall together, independent from the other claims appealed herein; claims 2 and 13 stand or fall together, independent from the other claims appealed herein; claims 3 and 14 stand or fall together independent of the other claims appealed herein; and claims 7 and 18 stand or fall together independent of the other claims appealed herein. The remaining claims to stand or fall with the claims on which they are dependent.

ARGUMENT

I. Rejection of Independent claims 1 and 12

The Examiner fails to make a *prima facie* case for the rejection of independent claims 1 and 12 as being obvious over Lindner in view of Papadopoulos '061 because even in combination, these references fail to teach express elements of these claims.

Each of these claims requires a "Web interface module" allowing the writing of data to the I/O modules directly from the Web "without intervention of the programmable logic controller". The Applicant and the Examiner agreed that Lindner does not teach controlling the output of the I/O modules without intervention of the PLC. See generally, page 4, first full paragraph of the Final Office Action.

Nor does Papadopoulos '061 teach such direct communication. Papadopoulos '061 describes the Web server 30 communicating directly only with the PLC 32 and provides no suggestion that there can be communication between the Web server 30 and the I/O modules 40 that does not pass through the PLC.

Papadopoulos '061 states that his invention:

> allows for easy access over commercial networks such as the Internet to information within a programmable logic controller (PLC). *Column 2, lines 59-62.*

and that his Web interface:

> translates the industry standard Ethernet, TCP/IP and HDTV protocols used on the Internet into data recognizable to the PLC. *Column 3, line 7-9.*

and further that:

> Web server 30 provides a direct connection for a programmable logic controller (PLC) 32 to the Internet 14 by plugging the Web server 30 into its backplane 34. *Column 4, lines 39-42.*

The details of the PLC interface with the Web server are provided at column 6, lines 15 to column 9, line 52. There is absolutely no suggestion of direct communication between the Web module and the I/O modules.

The Examiner has suggested that Papadopoulos '061 teaches communication between the Web server and the I/O modules without the intervention of the PLC because the Web server and the I/O modules are connected by a backplane.

This inherency argument is incorrect as a technical matter. It is well understood in the computer arts that a physical connection of two devices to a backplane doesn't mean that they can communicate with each other independent of the mediation of a separate processor. For example, in the computer on which this appeal brief is being drafted, there is a printer port card and a sound card both connected to a single backplane. They cannot communicate directly with each other but only with the computer's processor. In Papadopoulos '061, the Web server and the I/O modules do not communicate directly with each other but, as clearly indicated by Papadopoulos '061, communicate through the PLC.

The claims at issue in the present invention expressly require "communication may be had with the I/O module without intervention of the programmable logic controller." It is apparent from the description of Papadopoulos '061 that Papadopoulos '061 neither contemplated nor described such communication without mediation by the PLC.

Not only does Papadopoulos '061 fail to suggest direct Web control of I/O modules, Papadopoulos '061 fails to recognize or teach any way to manage the risk of malicious Web traffic wreaking havoc on controlled equipment or processes or the problem of conflicts between control from the Web and control from the PLC. It is apparent that Papadopoulos '061 either did

not recognize the potential benefit of a direct connection or believed that such a direct connection was unworkable.

In contrast, the present invention both expressly teaches direct communication between the Web and the I/O modules without intervention of the PLC, but also addresses the problems of spurious or malicious Web traffic or conflicting Web and PLC commands by using a PLC controllable but I/O module based lock table (see Fig. 5 and the corresponding sections of the specification) giving the PLC the ability to block communication (when the PLC is active) without monitoring that communication and without blocking that communication when the PLC is disabled or has not been initialized. The failure of Papadopoulos to address this issue supports the contention that Papadopoulos did not contemplate such a direct connection and that the possibility of such a direct connection was not obvious to Papadopoulos or those of skill in the art at this time.

II. Rejection of dependent claims 2 and 13

Each of these claims require that a processing unit in the Web interface module be able to receive a "write disable command" from the PLC that allows the Web interface module to continue to communicate with the I/O modules with respect to reading data but that blocks the ability of the Web interface module to write data to the I/O modules.

Each of these claims is dependent on claim 1 or 12 and thus is not anticipated by cited prior art for the reasons described above. Further, the Applicant can find no reference to a write disable command in the Examiner's cited column 4 of the Lindner reference. This is not surprising because such a write disable would not be required in the Lindner device because the output from the Web interface module is clearly mediated at all times by the programmable logic

controller. Only when there is a direct connection between the Web interface and the I/O modules outside of the programmable logic controller is a write disable command warranted.

The Katsuhiko patent does not remedy the deficiencies in Lindner. The Examiner indicates that Katsuhiko discloses a read/write of data but this is inadequate to teach or suggest the claim invention of:

> a write disable command from the programmable logic controller causing the stored program to allow direct reading of data from the I/O module but not direct writing of data to the I/O module.

A person of skill in the art combining these references would simply maintain the mediation of Internet communications via the PLC taught by Lindner. The PLC would assume ultimate control of writing or reading the I/O modules of eliminating any problem of malicious network traffic and any problem of conflicts between the PLC and the I/O modules.

The Examiner's rejection seems to improperly presuppose that the possibility of direct Web control of I/O modules was recognized and that the problem of malicious Web traffic in this architecture was understood. These assumptions are not supported by any of the art found by the Examiner. Further, even if the benefits of the present invention were known and the problems in implementing the present invention were recognized, there is no evidence that a Web server based lock table would have been recognized as providing a solution. Certainly the Examiner has failed to make a case that this solution would have been available from the prior art.

The Examiner suggests a motivation present in the prior art of desiring greater control over remote devices. The invention of these claims, in fact, decreases the control over the remote devices by selectively blocking Internet control of the remote I/O modules. The Examiner's expressed motivation thus teaches away from the present invention.

III. Rejection of dependent claims 3 and 14

Each of these claims requires connected messaging between the Web server module and the I/O modules. Connected messaging is a term of art and refers to a messaging system where the message resources and schedules are planned in advance to ensure that message communications are not dropped, lost, or unduly delayed. This is described in the present application at paragraph [0005].

Each of these claims is dependent on claim 1 or 12 and thus is not anticipated by this combination for the reasons described above.

Further, as described above, Lindner fundamentally fails to teach a Web interface module that may control I/O modules through the controller networking even when the PLC is not operational.

Further, Lindner does not teach or suggest the use of a connected messaging protocol with the web interface of Lindner. This deficiency is not remedied by Hauet which fails to teach connected messaging or any of the standards that would provide for connected messaging. The Examiner's citation of column 4, lines 35-45 describes Internet protocols. These Internet protocols are diametric opposites of connected messaging, allowing transmission in which packets are routinely lost or delayed and cannot be reliably assured to pass through the protocol in any given period of time. Accordingly, the combination of references not only fails to teach the limitations of these claims but also strongly teaches away from the present invention.

IV. Rejection of dependent claims 7 and 18

These claims require the data being transmitted from the Internet through the Web interface module and ultimately to the I/O modules, to control the I/O module, are transferred using an I/O image table. An I/O image table is a term of art and refers to a portion of memory that exactly reflects the state of the I/O modules in a snapshot in time. While this term is

understood in the art, it is also described at paragraph [0004]. To Applicant's knowledge, the use of an I/O image table has never been used to mediate control data with the Internet.

Applicant and the Examiner agree that Lindner fails to teach the use of the I/O image table in the capacity. See page 6 of the Final Office Action, second paragraph.

The Examiner notes that Papadopoulos describes "read/write" data at column 8, Table 1. Admittedly, this is some sort of data table but this disclosed mechanism fails to meet the limitations of these claims which requires:

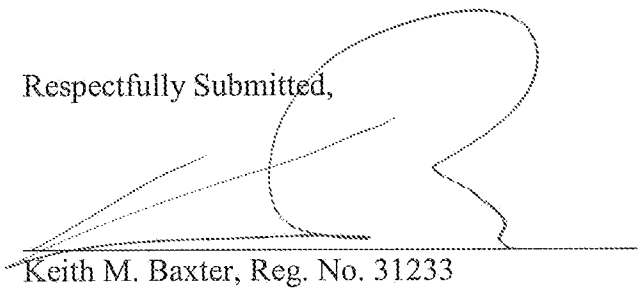
> where the transfer of data between the Web accessing communications medium and the I/O is implemented through the I/O image table.

The table described by Papadopoulos is in the words of Papadopoulos " a snapshot of the PLC 32 operations". If, in fact, I/O data is present in this table (and that is by no means clear from this disclosure) it is still not data from the I/O modules directly but rather data from the PLC. This suggests that Papadopoulos, if anything, teaches the use of an I/O table for communication with the PLC and a Web server, although that probably overstates what Papadopoulos teaches.

CONCLUSION

The combination of references relied upon does not fairly teach the limitations of claims 1, 2, 3, 7, 12, 13, 14, 18 or any of the claims dependant on these claims. Therefore, the Applicant requests that the Board overturn the Examiner's rejection of these claims and pass claims 1-22 to allowance.

Respectfully Submitted,



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CLAIMS APPENDIX

1. (previously presented) A Web interface module for an industrial control system including a programmable logic controller for executing an industrial control program, the programmable logic controller communicating over a controller network with I/O modules, the I/O modules sending and receiving electrical signals to and from an industrial process, the Web interface module comprising:

an Internet interface for connecting to a Web accessing communications medium;

a network interface for connecting to the controller network; and

a processing unit executing a stored program to communicate directly with at least one I/O module and to pass data between the Web accessing communications medium and the I/O module, the passing of data including the writing of data to the I/O modules defining the electrical signals to be sent by the I/O module to the industrial process and the reading of data from the I/O modules defined by electrical signals received by the I/O modules from the industrial process;

whereby communications may be had with the I/O module without intervention of the programmable logic controller.

2. (original) The Web interface module of claim 1 wherein the processing unit also executes the stored program to receive a write disable command from the programmable logic controller causing the stored program to allow direct reading of data from the I/O module but not direct writing of data to the I/O module;

whereby conflicting writing of data to the I/O module is prevented.

3. (original) The Web interface module of claim 1 wherein the network interface provides a connected messaging protocol.

4. (original) The Web interface module of claim 1 wherein the processing unit executing the stored program also opens at least one connection on the connected messaging network

between the programmable logic controller and the Web interface to transfer data between the programmable logic controller and the interface.

5. (original) The Web interface module of claim 1 wherein the connected messaging network is selected from the group consisting of Control Net, DeviceNet and EtherNet.

6. (original) The Web interface module of claim 1 wherein the Web accessing communications medium is selected from the group consisting of a wire cable, a fiber optic cable, and a radio link.

7. (original) The Web interface module of claim 1 wherein the processing unit executing the stored program opens connections on the connected messaging network with a plurality of I/O modules and wherein the processing unit includes an I/O image table and wherein the passing of data between the Web accessing communications medium and the I/O module separately reads and writes data between the Web accessing communications medium the I/O image table, and between the I/O modules and the I/O image table;

where the transfer of data between the Web accessing communications medium and the I/O is implemented through the I/O image table.

8. (original) The Web interface module of claim 7 wherein the processing unit executing the stored program reads and writes data between the I/O image table and the I/O modules in a predetermined order.

9. (original) The Web interface module of claim 1 wherein the connected messaging network comprises a parallel backplane between the Web interface module and the programmable logic controller and a serial network between the backplane and the I/O modules.

10. (original) The Web interface module of claim 9 wherein the network interface of the Web interface module attaches to the backplane.

11. (original) The Web interface module of claim 9 wherein the network interface of the Web interface module attaches to the serial network.

12. (previously presented) An industrial control system for an industrial control system comprising:

a plurality of I/O modules sending and receiving electrical signals to and from an industrial process;

a controller network communicating with the I/O modules;

a programmable logic controller attachable to the controller network to execute a stored control program to exchange data with the I/O modules over the controller network to control the industrial process; and

a Web interface module including:

(a) an Internet interface for connecting to a Web accessing communications medium;

(b) a network interface for connecting to the controller network; and

(c) a processing unit executing a stored interface program to communicate directly with at least one I/O module and to pass data between the Web accessing communications medium and the I/O module, the passing of data including the writing of data to the I/O modules defining the electrical signals to be sent by the I/O module to the industrial process and the reading of data from the I/O modules defined by electrical signals received by the I/O modules from the industrial process;

whereby communications may be had with the I/O module without intervention of the programmable logic controller.

13. (original) The industrial control system of claim 12 wherein the processing unit also executes the stored program to receive a write disable command from the

programmable logic controller causing the stored interface program to allow direct reading of data from the I/O module but not direct writing of data to the I/O module;

whereby conflicting writing of data to the I/O module is prevented.

14. (previously presented) An industrial control system comprising:

a plurality of I/O modules sending and receiving electrical signals to and from an industrial process;

a connected messaging network communicating with the I/O modules;

a programmable logic controller attachable to the controller network to execute a stored control program to open connections and exchange data with the I/O modules over the connected messaging network to control the industrial process; and

a Web interface module including:

(a) an Internet interface for connecting to a Web accessing communications medium;

(b) a network interface for connecting to the connected messaging network;

and

(c) a processing unit executing a stored interface program to open connections on the connected messaging network between at least one I/O module and the Web interface module and to pass data between the Web accessing communications medium and the I/O module the passing of data including the writing of data to the I/O modules defining the electrical signals to be sent by the I/O module to the industrial process and the reading of data from the I/O modules defined by electrical signals received by the I/O modules from the industrial process;

whereby communications may be had with the I/O module without intervention of the programmable logic controller.

15. (original) The industrial control system of claim 14 wherein the processing unit executing the stored interface program also opens at least one connection on the connected messaging network between the programmable logic controller and the Web interface to transfer data between the programmable logic controller and the interface.

16. (original) The industrial control system of claim 14 wherein the connected messaging network is selected from the group consisting of ControlNet, DeviceNet, and EtherNet.

17. (original) The industrial control system of claim 14 wherein the Web accessing communications medium is selected from the group consisting of a wire cable, a fiber optic cable, and a radio link.

18. (original) The industrial control system of claim 14 wherein the processing unit executing the stored interface program opens connections on the connected messaging network with a plurality of I/O modules and wherein the processing unit includes an I/O image table and wherein the passing of data between the Web accessing communications medium and the I/O module separately reads and writes data between the Web accessing communications medium and the I/O image table, and between the I/O modules and the I/O image table;

where the transfer of data between the Web accessing communications medium and the I/O is implemented through the I/O image table.

19. (original) The industrial control system of claim 18 wherein the processing unit executing the stored interface program reads and writes data between the I/O image table and the I/O modules in a predetermined order.

20. (original) The industrial control system of claim 14 wherein the connected messaging network comprises a parallel backplane between Web interface module and the programmable logic controller and a serial network between the backplane and the I/O modules.

21. (original) The industrial control system of claim 20 wherein the network interface of the Web interface module attaches to the backplane.

22. (previously presented) The industrial control system of claim 14 wherein the network interface of the Web interface module attaches to the serial network.

EVIDENCE APPENDIX

Applicant submits no evidence pursuant to 37 CFR §1.130, 1.131 or 1.132 or any other evidence beyond the references cited in the present application.

RELATED PROCEEDINGS APPENDIX

No decision from a related proceeding has been rendered by a court or this Board.